WHAT IS CLAIMED IS:

1. A plasma spray system, comprising:

a vacuum chamber;

one or more target assemblies positioned within the vacuum chamber, the target assemblies including one or more target drive assemblies adapted to move one or more cylindrical targets at varying rates;

one or more power supplies;

one or more plasma gas assemblies;

one or more plasma spray devices operably adjoined to the one or more power supplies and the one or more plasma gas assemblies, wherein the plasma spray devices are oriented to direct one or mores plasma streams toward one or more deposition zones on the cylindrical targets;

one or more coating feeder apparatuses operably adjoined to one or more plasma spray devices for providing a coating material to the plasma streams for deposition on the cylindrical targets; and

a vacuum system operably adjoined to the vacuum chamber.

2. The plasma spray system of claim 1 further comprising one or more particle control assemblies including one or more particle control conduits oriented to direct gas flows across the plasma streams between the plasma spray devices and the cylindrical targets to divert smaller plasma-sprayed particles and other small particles beyond the cylindrical targets.

3. The plasma spray system of claim 1 wherein the target drive assemblies are adapted to stop and start the motion of one or more cylindrical targets at varying points.

4. The plasma spray system of claim 2 wherein the one or more plasma spray devices are operatively connected to a supply of anaerobic gas.

5. The plasma spray system of claim 2 wherein the one or more plasma spray devices are operatively connected to a supply of reducing gas.

6. The plasma-spray system of claim 1 wherein the one or more target drive assemblies move the one or more cylindrical targets laterally with respect to the plasma spray device at a varying rate.

7. The plasma spray system of claim 1 wherein the one or more target drive assemblies rotate the one or more cylindrical targets about central axes of their cylindrical cores at a varying rate.

8. The plasma spray system of claim 5 wherein the one or more target drive assemblies rotate the one or more cylindrical target about central axes of their cylindrical cores at a varying rate.

9. The plasma spray system of claim 1 further comprising one or more preclean gas assemblies including one or more preclean gas conduits operably coupled to one or more gas storage units and oriented to direct gas flows or systematic blasts onto the deposition zones of the cylindrical targets before the deposition zones enter the plasma stream.

10. The plasma spray system of claim 2 further comprising a preclean gas assembly including one or more preclean gas conduits operably coupled to one or more gas storage units and oriented to direct a gas flow or systematic blast onto the deposition zones of the cylindrical targets before the deposition zones enter the plasma streams.

11. The plasma spray system of claim 1 wherein the vacuum system comprises a vacuum duct operably adjoined to the vacuum chamber, including:

a blower system coupled to the vacuum duct for generating a vacuum flow;

a chamber outlet having a reversibly constricting chamber outlet end;

a venturi tube section positioned between the vacuum chamber and the blower system; and

a gas detector positioned proximate to the chamber outlet for monitoring the backstreaming of atmospheric gases.

12. The plasma spray system of claim 11 wherein the chamber outlet includes a telescope channel operably coupled to the reversibly constricting chamber outlet end.

13. The plasma spray system of claim 12 wherein the reversibly constricting chamber outlet end includes compression devices operably coupled to rollers that apply pressure to the chamber outlet end thereby constricting the chamber outlet end as the telescope channel is extended into the venturi tube section.

14. The plasma spray system of claim 11 wherein the reversibly constricting chamber outlet includes a tightening clamp extending around the chamber outlet end.

15. The plasma spray system of claim 1 further comprising a central control unit preprogrammed to transmit and control the function of one or more components of the plasma spray system.

16. The plasma spray system of claim 15 wherein the one or more components of the plasma spray system are selected from the group consisting of plasma spray devices, power sources, target assemblies, drive assemblies, coating feeder apparatuses, the vacuum system, water supplies, chamber outlet, telescope channel, tightening clamp, particle control assemblies, preclean gas assemblies and gas assemblies.

17. A plasma spray system, comprising:

a vacuum chamber;

one or more target assemblies including one or more target drive assemblies configured to move one or more cylindrical targets rotationally, laterally, longitudinally or any combination thereof;

one or more power supplies;

one or more plasma gas assemblies;

one or more plasma spray devices operably adjoined to the one or more power supplies and the one or more plasma gas assemblies, wherein the plasma spray devices are oriented to direct a plasma stream toward a deposition zone on the cylindrical target;

one or more particle control assemblies including one or more particle control conduits oriented to direct gas flows across the plasma streams between the plasma spray devices and the cylindrical targets to divert smaller plasma-sprayed particles and other small particles beyond the cylindrical targets;

a vacuum system operably adjoined to the vacuum chamber; and

one or more coating feeder apparatuses operably adjoined to one or more plasma spray devices for providing a coating material to the plasma streams for deposition on the cylindrical targets.

18. The plasma spray system of claim 17 wherein the target drive assemblies are adapted to stop and start the motion of one or more cylindrical targets at varying points.

19. The plasma spray system of claim 17 further comprising one or more preclean gas assemblies including one or more preclean gas conduits operably coupled to one or more gas

storage units and oriented to direct gas flows or systematic blasts onto the deposition zones of the cylindrical targets before the deposition zones enter the plasma stream.

20. The plasma spray system of claim 17 wherein the vacuum system comprises a vacuum duct operably adjoined to the vacuum chamber, including:

a blower system coupled to the vacuum duct for generating a vacuum flow;

a chamber outlet having a reversibly constricting chamber outlet end;

a venturi tube section positioned between the vacuum chamber and the blower system; and

a gas detector positioned proximate to the chamber outlet for monitoring the backstreaming of atmospheric gases.

21. The plasma spray system of claim 20 wherein the chamber outlet includes a telescope channel operably coupled to the reversibly constricting chamber outlet end.

22. The plasma spray system of claim 21 wherein the reversibly constricting chamber outlet end includes compression devices operably coupled to rollers that apply pressure to the chamber outlet end thereby constricting the chamber outlet end as the telescope channel is extended into the venturi tube section.

23. The plasma spray system of claim 17 wherein the reversibly constricting chamber outlet includes a tightening clamp extending around the chamber outlet end.

24. The plasma spray system of claim 17 further comprising a central control unit preprogrammed to transmit and control the function of one or more components of the plasma spray system.

25. The plasma spray system of claim 24 wherein the one or more components of the plasma spray system are selected from the group consisting of plasma spray devices, power sources, target assemblies, drive assemblies, coating feeder apparatuses, the vacuum system, water supplies, chamber outlet, telescope channel, tightening clamp, particle control assemblies, preclean gas assemblies and gas assemblies.

26. A plasma spray system, comprising:

a vacuum chamber;

one or more target assemblies positioned within the vacuum chamber, the target assemblies having one or more target drive assemblies configured to move one or more cylindrical targets rotationally, laterally, longitudinally or any combination thereof;

one or more power supplies;

one or more plasma gas assemblies;

one or more plasma spray devices operably adjoined to the one or more power supplies and the one or more plasma gas assemblies, wherein the plasma spray devices are oriented to direct one or more plasma streams toward one or more deposition zones on the cylindrical targets;

one or more coating feeder apparatuses operably adjoined to one or more plasma spray devices for providing a coating material to the plasma streams for deposition on the cylindrical targets;

one or more preclean gas assemblies including one or more preclean gas conduits operably coupled to one or more gas storage units and oriented to direct gas flows or systematic blasts onto the deposition zones of the cylindrical targets before the deposition zones enter the plasma stream; and

a vacuum system operably adjoined to the vacuum chamber.

27. The plasma spray system of claim 26 wherein the target drive assemblies are adapted to stop and start the motion of one or more cylindrical targets at varying points.

28. The plasma spray system of claim 26 further comprising one or more particle control assemblies including one or more particle control conduits oriented to direct gas flows across the plasma streams between the plasma spray devices and the cylindrical targets to divert smaller plasma-sprayed particles and other small particles beyond the cylindrical targets.

29. The plasma spray system of claim 26 wherein the vacuum system comprises a vacuum duct operably adjoined to the vacuum chamber, including:

a blower system coupled to the vacuum duct for generating a vacuum flow;

a chamber outlet having a reversibly constricting chamber outlet end;

a venturi tube section positioned between the vacuum chamber and the blower system;

and

a gas detector positioned proximate to the chamber outlet for monitoring the backstreaming of atmospheric gases.

30. The plasma spray system of claim 29 wherein the chamber outlet includes a telescope channel operably coupled to the reversibly constricting chamber outlet end.

31. The plasma spray system of claim 30 wherein the reversibly constricting chamber outlet end includes compression devices operably coupled to rollers that apply pressure to the chamber outlet end thereby constricting the chamber outlet end as the telescope channel is extended into the venturi tube section.

32. The plasma spray system of claim 29 wherein the reversibly constricting chamber outlet includes a tightening clamp extending around the chamber outlet end.

33. The plasma spray system of claim 27 further comprising a central control unit preprogrammed to transmit and control the function of one or more components of the plasma spray system.

34. The plasma spray system of claim 33 wherein the one or more components of the plasma spray system are selected from the group consisting of plasma spray devices, power sources, target assemblies, drive assemblies, coating feeder apparatuses, the vacuum system, water

supplies, chamber outlet, telescope channel, tightening clamp, particle control assemblies, preclean gas assemblies and gas assemblies.

35. A vacuum system comprising:

a vacuum duct operably adjoined to the vacuum chamber, including:

a blower system coupled to the vacuum duct for generating a vacuum flow;

a chamber outlet having a reversibly constricting chamber outlet end;

a venturi tube section positioned between the vacuum chamber and the blower system; and

a gas detector positioned proximate to the chamber outlet for monitoring the backstreaming of atmospheric gases.

36. The vacuum system of claim 35 wherein the chamber outlet includes a telescope channel operably coupled to the reversibly constricting chamber outlet end.

37. The vacuum system of claim 36 wherein the reversibly constricting chamber outlet end includes compression devices operably coupled to rollers that apply pressure to the chamber outlet end thereby constricting the chamber outlet end as the telescope channel is extended into the venturi tube section.

38. The vacuum system of claim 35 wherein the reversibly constricting chamber outlet includes a tightening clamp wrapped around the chamber outlet end.

39. A method of uniformly coating a cylindrical target comprising:

a. mounting a cylindrical target to a target assembly;

b. moving the cylindrical target at a constant or variable rate rotationally, laterally, longitudinally or any combination thereof;

c. activating one or more plasma spray devices to generate one or more plasma streams for plasma spraying particles of a coating material toward a deposition zone on the cylindrical target; and

d. plasma spraying particles of coating material on the cylindrical target until a uniform coating of desired thickness is achieved.

40. The method of uniformly coating a cylindrical target of claim 39 further comprising the step of starting and stopping the motion of the cylindrical target at varying points.

41. The method of uniformly coating a cylindrical target of claim 39 further comprising directing gas flow across the plasma streams between the plasma spray devices and the cylindrical target to divert smaller plasma-sprayed particles and other small particles beyond the cylindrical target.

42. The method of uniformly coating a cylindrical target of claim 39 further comprising directing a gas flow or systematic blast onto a surface location of the cylindrical target proximate to the deposition zone before entering the plasma stream to preclean the deposition zone.

43. The method of uniformly coating a cylindrical target of claim 41 further comprising directing a gas flow or systematic blast onto a surface location of the cylindrical target proximate to the deposition zone before entering the plasma stream to preclean the deposition zone.

44. A method of coating a cylindrical target comprising:

a. mounting a cylindrical target to a target assembly;

b. moving the cylindrical target at a constant or variable rate rotationally, laterally, longitudinally or any combination thereof;

c. activating one or more plasma spray devices to generate one or more plasma streams for plasma spraying particles of a coating material toward a deposition zone on the cylindrical target;

d. directing gas flow across the plasma streams between the plasma spray devices and the cylindrical target to divert smaller plasma-sprayed particles and other small particles beyond the cylindrical target; and

e. plasma spraying particles of coating material on the cylindrical target until a uniform coating of predetermined thickness is attained.

45. The method of coating a cylindrical target of claim 44 further comprising the step of starting and stopping the motion of the cylindrical target at varying points.

46. The method of coating a cylindrical target of claim 44 further comprising directing a gas flow or systematic blast of gas onto a surface location of the cylindrical target proximate to the deposition zone before entering the plasma stream to preclean the deposition zone.

47. The method of coating a cylindrical target of claim 44 further comprising maintaining the gas flow at a rate that will divert particles smaller than a predetermined size beyond the deposition zone, while allowing larger particles to deposit on the cylindrical target within the deposition zone.

48. The method of coating a cylindrical target of claim 47 wherein said predetermined size is less than 10 micrometers.

49. The method of coating a cylindrical target of claim 44 wherein the gas flow comprises an anaerobic gas.

50. The method of coating a cylindrical target of claim 49 wherein the anaerobic gas is nitrogen.

51. The method of coating a cylindrical target of claim 44 wherein the gas flow comprises a reducing gas.

52. A method of coating a cylindrical target comprising:

a. mounting a cylindrical target to a target assembly;

b. moving the cylindrical target at a variable or constant rate rotationally, laterally, longitudinally or any combination thereof;

c. starting and stopping the motion of the cylindrical target at varying points;

d. activating one or more plasma spray devices to generate one or more plasma streams for plasma spraying particles of a coating material toward a deposition zone on the cylindrical target;

e. directing a gas flow or systematic blast of gas onto a surface location of the cylindrical target proximate to the deposition zone before entering the plasma streams to preclean the deposition zone; and

f. plasma spraying particles of coating material on the cylindrical target until a uniform coating of predetermined thickness is attained.